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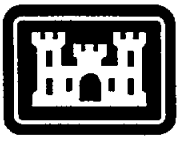
Formerly Utilized Sites Remedial Action Program (FUSRAP)

# ADMINISTRATIVE RECORD

## for the Maywood Site, New Jersey



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M-683

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HEALTH AND SAFETY RESEARCH DIVISION

Nuclear and Chemical Waste Programs
(Activity No. AH 10 05 00 0; ONLWCO1)

# RESULTS OF THE RADIOLOGICAL SURVEY AT 266 EAST SPRING VALLEY AVENUE (MJ024), HACKENSACK, NEW JERSEY

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# CONTENTS

# LIST OF FIGURES

# LIST OF TABLES

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# RESULTS OF THE RADIOLOGICAL SURVEY AT 266 EAST SPRING VALLEY AVENUE (MJ024), HACKENSACK, NEW JERSEY*

## INTRODUCTION

From 1916 to 1956, process wastes and residues associated with the production and refining of thorium and thorium compounds from monazite ores were generated by the Maywood Chemical Works (MCW), Maywood, New Jersey. During the latter part of this period, MCW supplied rare earth metals and thorium compounds to various government agencies. In the 1940s and 1950s, MCW produced thorium and lithium, under contract, for the Atomic Energy Commission (AEC). These activities ceased in 1956, and approximately three years later, the 30-acre real estate was purchased by the Stepan Company. The property is located at 100 Hunter Avenue in a highly developed area in Maywood and Rochelle Park, Bergen County, New Jersey.

During the early years of operation, MCW stored wastes and residues in low-lying areas west of the processing facilities. In the early 1930s, these areas were separated from the rest of the property by the construction of New Jersey State Highway 17. The Stepan property, the interim storage facility, and several vicinity properties have been designated for remedial action by the Department of Energy (DOE).

The waste produced by the thorium extraction process was a sandlike material containing residual amounts of thorium and its decay products, with smaller quantities of uranium and its decay products. During the years 1928 and 1944 to 1946, area residents used these process wastes mixed with tea and cocoa leaves as mulch in their lawns and gardens. In addition, some of the contaminated wastes were apparently eroded from the site into Lodi Brook and carried downstream.

As a result of the Energy and Water Appropriations Act of Fiscal Year 1984, the property discussed in this report and properties in its vicinity contaminated with residues from the former MCW were included as a decontamination research and development project under the DOE Formerly Utilized Sites Remedial Action Program. As part of this project, DOE is conducting radiological surveys in the vicinity of the site to identify properties contaminated with residues derived from the MCW. The principal radionuclide of concern is thorium-232. The radiological survey discussed in this report is part of that effort and was conducted, at the request of DOE, by members of the Measurement Applications and Development Group of Oak Ridge National Laboratory.

A radiological survey of the private, residential property at 266 East Spring Valley Avenue, Hackensack, New Jersey, was conducted during 1987. The survey and sampling of the ground surface and subsurface were carried out on April 23, 1987.

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*The survey was performed by members of the Measurement Applications and Development Group of the Health and Safety Research Division at Oak Ridge National Laboratory under DOE contract DE-AC05-84OR21400.

## SURVEY METHODS

The radiological survey of the property included a gamma scan of the entire property outdoors and collection of surface and subsurface soil samples. No indoor survey measurements were performed.

Using a portable gamma scintillation meter, ranges of measurements were recorded for areas of the property surface. Systematic soil samples were then obtained at randomly selected locations irrespective of gamma exposure rates. In addition, biased soil samples were collected in areas of elevated gamma levels. These survey methods followed the plan outlined in Reference 1. A comprehensive description of the survey methods and instrumentation is presented in *Procedures Manual for the ORNL Radiological Activities (RASA) Program*, Oak Ridge National Laboratory, ORNL/TM-8600 (April 1987).[2]

## SURVEY RESULTS

Applicable federal guidelines are summarized in Table 1.[3] The normal background radiation levels for the northern New Jersey area are presented in Table 2. These data are provided for comparison with survey results presented in this section. All direct measurement results presented in this report are gross readings; background radiation levels have not been subtracted. Similarly, background concentrations have not been subtracted from radionuclide concentrations measured in environmental samples.

### Surface Gamma Radiation Levels

Gamma radiation levels measured during a gamma scan of the surface of the property are given in Fig. 1. Gamma exposure rates over the major portion of the property ranged from 7 to 15 $\mu$R/h. Elevated gamma levels occurred near a brick and gravel area at the front of the house (17 to 25 $\mu$R/h) and at the back of the house near a metal shed (15 to 17 $\mu$R/h) and near the pool (11 to 17 $\mu$R/h).

### Systematic and Biased Soil Samples

Six systematic soil samples (S1A-D and S2A-B) and five biased soil samples (B1A-C and B2A-B) were taken for radionuclide analyses from depths of 0 to 60 cm (systematic samples) and 0 to 45 cm (biased samples), at increments of 15 cm. Locations of the samples are shown in Fig. 2, with results of laboratory analyses provided in Table 3. Concentrations of $^{226}$Ra and $^{232}$Th in the systematic samples ranged from 0.74 to 1.3 pCi/g and from 0.86 to 3.5 pCi/g, respectively. In the biased samples, concentrations ranged from 0.75 to 1.6 pCi/g for $^{226}$Ra and from 1.3 to 6.8 pCi/g for $^{232}$Th. All areas on the site are in compliance with the general criteria of 5 and 15 pCi/g for surface and subsurface soil, respectively, averaged over 100 m$^2$. The average concentrations of $^{232}$Th in the contaminated areas are 1.8 pCi/g for the area near the pool (8.7 m$^2$) and 1.2 pCi/g for the area in the front yard (4.4 m$^2$). These concentrations are well within the "hot spot" criteria shown in Table 1. Radium-226 concentrations in some samples were slightly elevated above

background for the northern New Jersey area (Table 2), but all concentrations were well below DOE guidelines.

## SIGNIFICANCE OF FINDINGS

Measurements taken at 226 East Spring Valley Avenue indicate that the property contained radioactive contamination primarily from the $^{232}$Th decay chain, with some contamination from $^{226}$Ra. These radionuclide distributions are typical of the type of material originating from the processing operations at MCW. However, all areas of this property conform to the radiological guidelines established for the Maywood, New Jersey, remedial action plan.

## REFERENCES

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2. T. E. Myrick, B. A. Berven, W. D. Cottrell, W. A. Goldsmith, and F. F. Haywood, *Procedures Manual for the ORNL Radiological Survey Activities (RASA) Program,* Oak Ridge National Laboratory, ORNL/TM-8600 (April 1987).
3. U.S. Department of Energy, *Guidelines for Residual Radioactivity at Formerly Utilized Sites, Remedial Action Program and Remote Surplus Facilities Management Program Sites* (Rev. 2, March 1987).
4. T. E. Myrick and B. A. Berven, *State Background Radiation Levels: Results of Measurements Taken During 1975-1979,* Oak Ridge National Laboratory, ORNL/TM-7343 (November 1981).

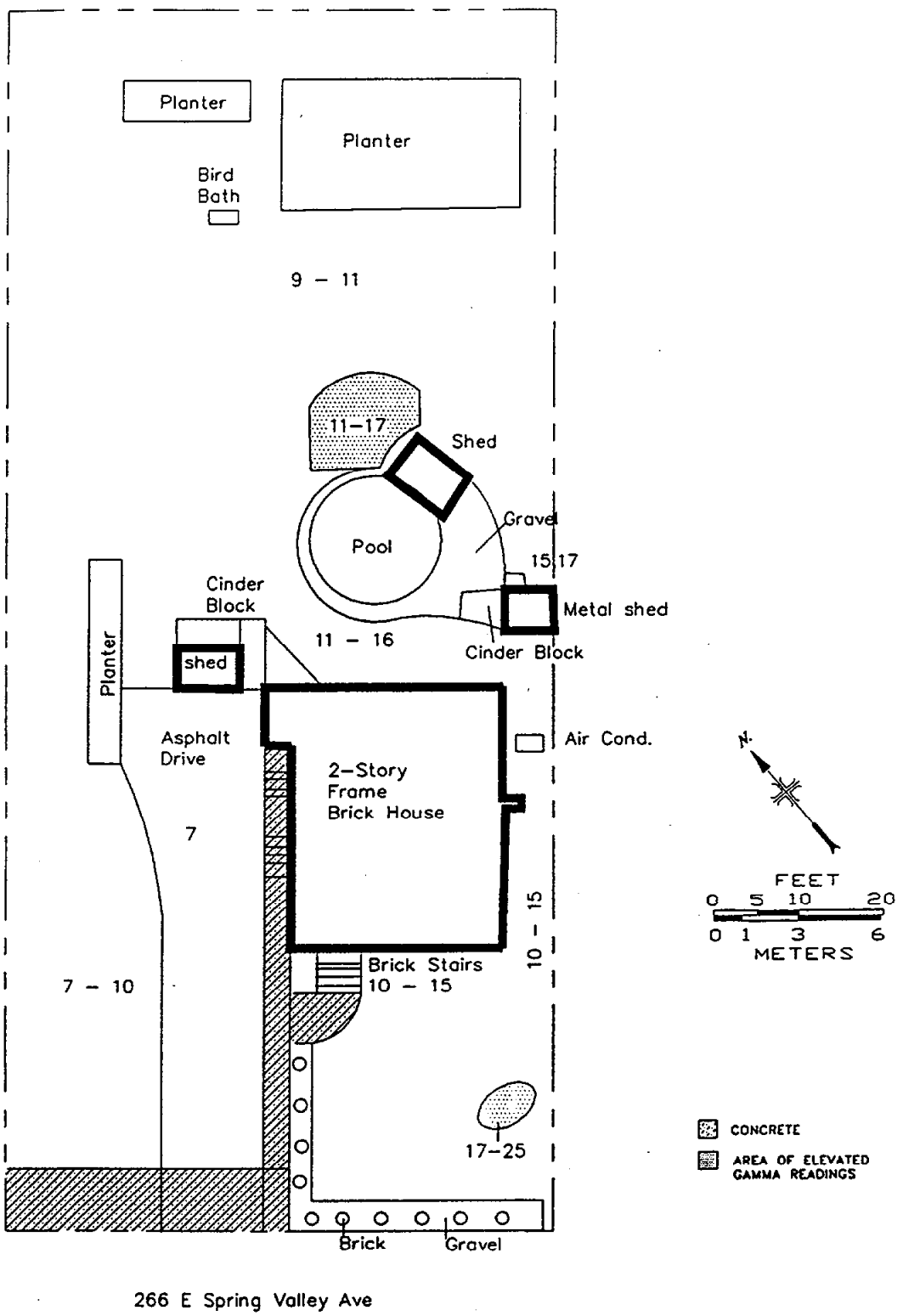


Fig. 1. Gamma radiation levels ($\mu$R/h) measured on the surface at 266 East Spring Valley Avenue, Hackensack, New Jersey (MJ024).

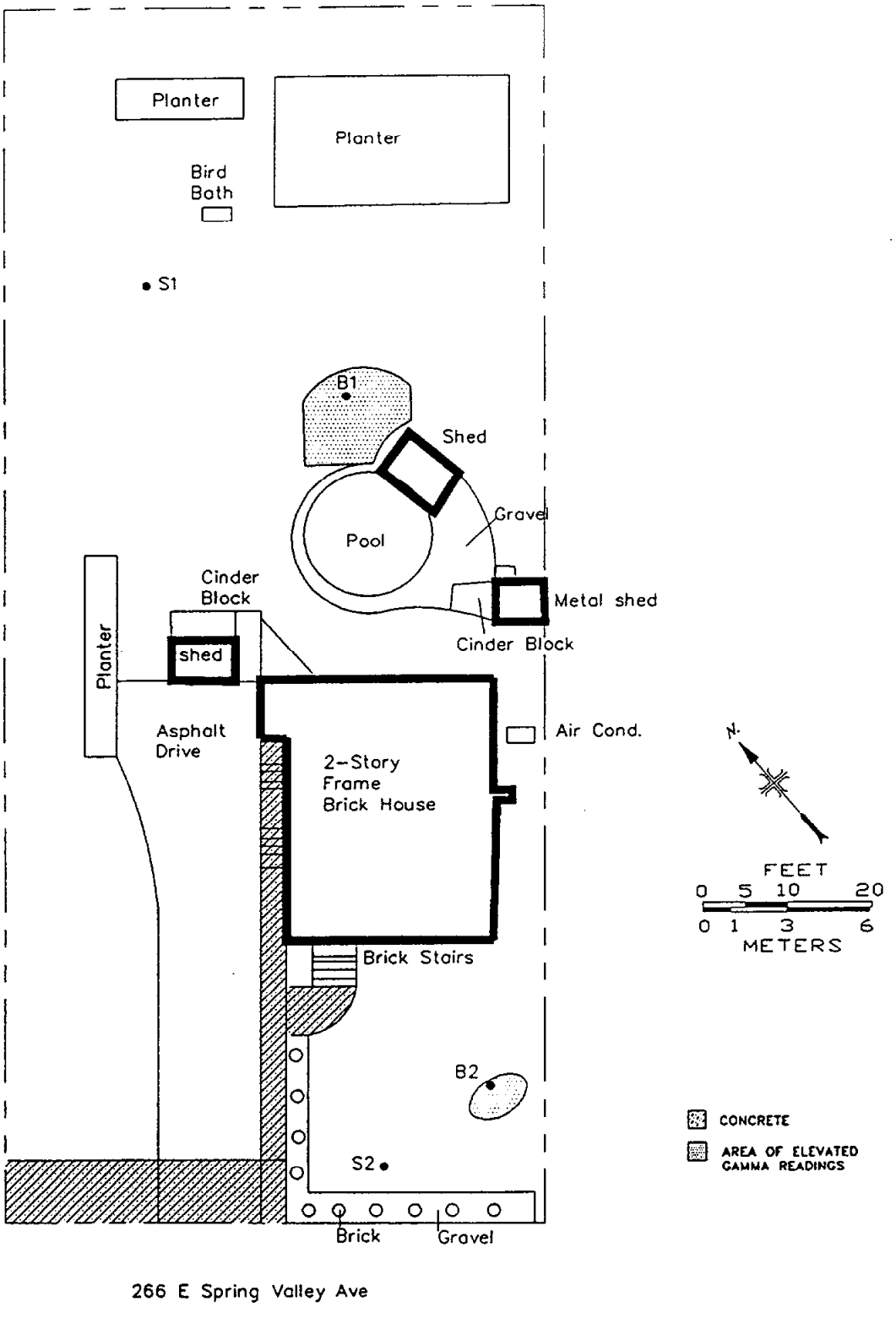


Fig. 2. Diagram showing locations of soil samples taken at 266 East Spring Valley Avenue, Hackensack, New Jersey (MJ024).

**Table 1. Applicable guidelines for protection against radiation[a]**

| Mode of exposure | Exposure conditions | Guideline value |
|---|---|---|
| Radionuclide concentrations in soil | Maximum permissible concentration of the following radionuclides in soil above background levels averaged over 100 $m^2$ area<br>$^{232}Th$<br>$^{230}Th$<br>$^{228}Ra$<br>$^{226}Ra$ | 5 pCi/g averaged over the first 15 cm of soil below the surface; 15 pCi/g when averaged over 15-cm thick soil layers more than 15 cm below the surface |
| Guidelines for nonhomogeneous contamination (used in addition to the 100 $m^2$ guideline)[b] | Applicable to locations meeting the above criterion but $\leq$25 $m^2$ with significantly elevated concentrations of radionuclides | Concentration limits for application to "hot spots" varying in size as follows:<br>($m^2$) (pCi/g)[c]<br><1 50<br>1–<3 30<br>3–<10 15<br>10–25 10 |

[a]From Reference 3.

[b]"Every reasonable effort shall be made to identify and remove any source which has a concentration exceeding 30 times the guideline value, irrespective of area."

[c]These guideline values are applicable to surface concentrations of $^{232}Th$, $^{230}Th$, $^{228}Ra$, and $^{226}Ra$ only; for other radionuclides and subsurface values, see Reference 3.

**Table 2. Background radiation levels for the northern New Jersey area**

| Type of radiation measurement or sample | Radiation level or radionuclide concentration |
|---|---|
| Concentration of radionuclides in soil (pCi/g) | |
| $^{232}Th$ | 0.9[a] |
| $^{238}U$ | 0.9[a] |
| $^{226}Ra$ | 0.9[a] |

[a]Reference 4.

**Table 3. Concentrations of radionuclides in soil at 266 East Spring Valley Avenue, Hackensack, New Jersey (MJ024)**

| Sample[a] | Depth (cm) | Radionuclide concentration (pCi/g) | |
|---|---|---|---|
| | | $^{226}Ra$[b] | $^{232}Th$[b] |
| | | *Systematic samples*[c] | |
| S1A | 0–15 | 0.95 ± 0.06 | 0.97 ± 0.4 |
| S1B | 15–30 | 0.74 ± 0.1 | 0.86 ± 0.09 |
| S1C | 30–45 | 1.0 ± 0.1 | 1.0 ± 0.1 |
| S1D | 45–60 | 1.1 ± 0.07 | 1.1 ± 0.2 |
| S2A | 0–15 | 1.3 ± 0.1 | 3.5 ± 0.4 |
| S2B | 15–30 | 1.2 ± 0.02 | 1.3 ± 0.04 |
| | | *Biased samples*[d] | |
| B1A | 0–15 | 1.6 ± 0.07 | 5.7 ± 0.3 |
| B1B | 15–30 | 1.3 ± 0.06 | 2.2 ± 0.2 |
| B1C | 30–45 | 1.3 ± 0.2 | 1.3 ± 0.2 |
| B2A | 0–15 | 1.5 ± 0.1 | 6.8 ± 0.5 |
| B2B | 15–30 | 0.75 ± 0.02 | 1.6 ± 0.04 |

[a]Locations of soil samples are shown on Fig. 2.

[b]Indicated counting error is at the 95% confidence level ($\pm 2\sigma$).

[c]Systematic samples are taken at grid locations irrespective of gamma exposure.

[d]Biased samples are taken from areas shown to have elevated gamma exposure rates.

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